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July 26,2005

National Institute of Standards and Technology
Gaithersburg, MD

Re: Recommendations resulting from the World Trade Center Investigation

To Whom It May Concern:

Because of limited access to discussions and recommendations being made as the result of the World Trade Center disaster, the subject matter of this letter may not be exactly what NIST is looking for where improvements in building safety are concerned. Much has been written and said in discussing the matter but my concern is almost solely based on the subject of positioning of egress stairways.

In my opinion, based on that information available to me, primarily the FEMA World Trade Center Building Performance Study, Second Printing; articles in Architectural Record; and articles written by Richard Schulte in Plumbing Engineer; insufficient attention is being given to the positioning or placement of exit stairways.

Quoting from the FEMA report: 1) Executive Summary (page 3) "Similarly several design features have been identified that may have played a role in allowing the buildings to collapse in the manner that they did and in the inability of victims at and above the impact floors to safely exit" and "grouping emergency egress stairways in the central building core, as opposed to dispersing them throughout the structure". 2) "Egress systems currently in use should be evaluated for redundancy and robustness in providing egress when building damage occurs, including the issue of transfer floors, stair spacing and locations, and stairwell enclosure impact resistance".

Then in Chapter 1, Section 1.5 Overview of Building Codes and Fire Standards 1.5.1, next to last paragraph – "At least two stairways must be provided with widely separated entry points". But, in my opinion, it is even more essential, in light of the World Trade Center tragedy" that the stairway enclosures be well separated.

In Chapter 2, Section 2.2.1 concerning WTC 1 is a statement to the effect "Partial collapse of floors in this zone appears to have occurred over a horizontal length of approximately 65 feet. The 65 foot figure would be sufficient to effect all 3 stairways. Section 2.2.1.3 Evacuation, concerning WTC 1 and 2 contains the statement "People within and above the impact are could not evacuate, simply because the stairways in the impact area had been destroyed". So, even though the buildings remained standing for more than an hour, persons above the 2-4 impact areas no longer had a stairway to use.

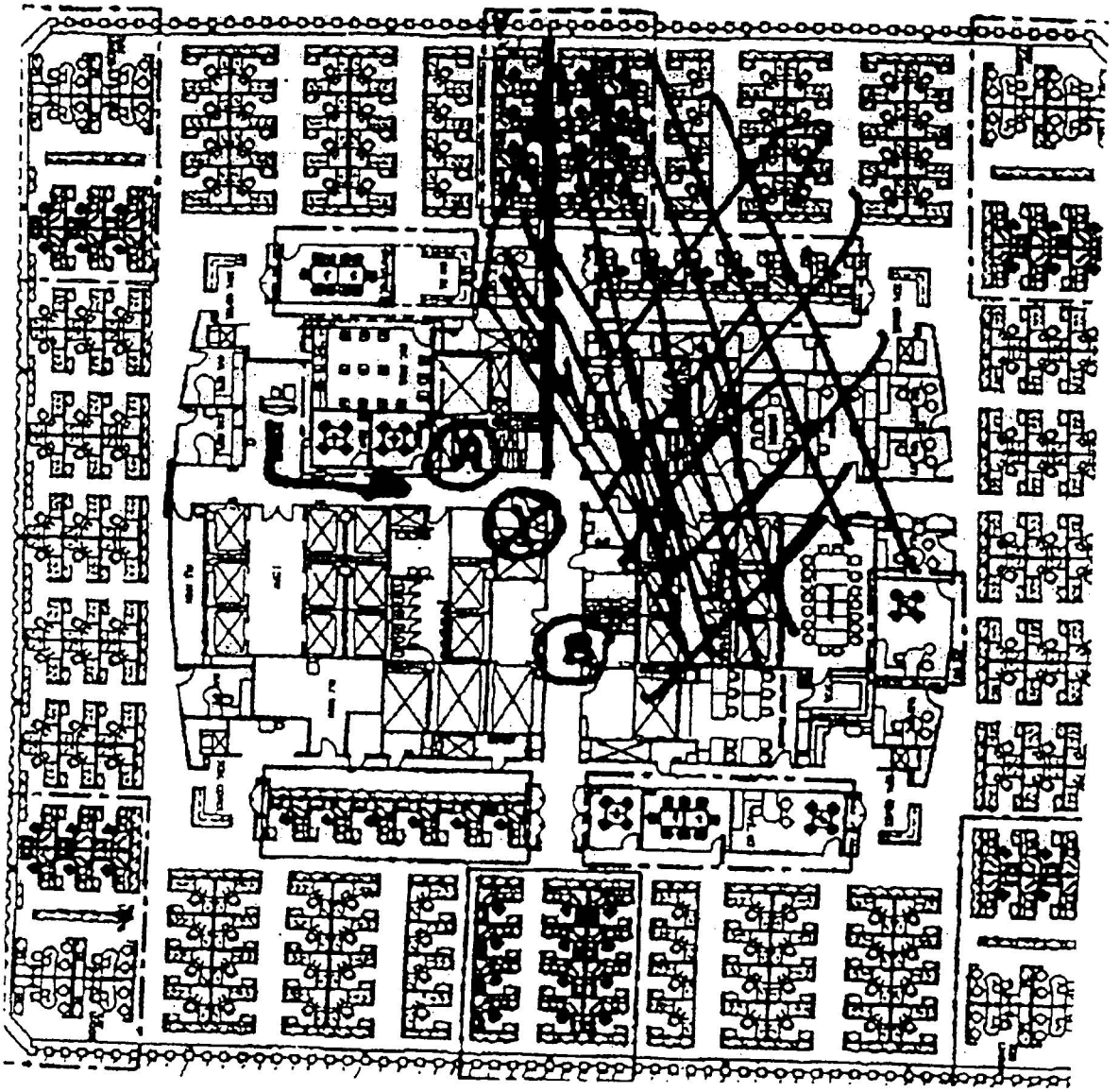
Under Section 2.3 Observations and Findings (page 2-38) is a reference to "Several building design features". "These features should not be regarded either as design deficiencies or as features that should be prohibited in future building codes. Rather these are features that should be subjected too more detailed evaluation. These include the following:...grouping emergency egress stairways in the central building core, as opposed to dispersing them throughout the structure".

Surprisingly, in spite of all the above information, the Recommendations Section 2.4 is completely silent on the subject of stairway separation and location.

In August, 2002 I sent a letter to both the New York Fire Department and Building Department Commissioners. These letters outlined just how building codes had modified exit stairway requirements. A copy of that letter is enclosed. I believe that will adequately clarify my position. Had the 3 stairways been "widely separated", at least one would have been available for the use of those above the fire involved floors.

Sincerely,

John "Gus" Degenkolb
Fire Protection Engineer – Code Consultant



APPROXIMATE DEBRIS LOCATION ON THE 91st FLOOR OF WTC 1

- N -

Figu
Appr
floor

John G. Degenkolb

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24 August 2002

Chief Daniel Nigro
Fire Department of New York
9 Metrotech
Brooklyn, NY 11201

Commissioner Nicholas Scoppetta
City of New York Fire Department
9 Metro Tech
Brooklyn, NY 11201

Patricia Lancaster, Commiddioner
New York Department of Buildings
280 Broadway
New York, NY 10007-1860

Dear Commissioner and Fire Chief:

I am writing to express my concern regarding the arrangement of exit stairways in high rise buildings as a result of the World Trade Center disaster.

I am a retired Battalion Chief of the Los Angeles Fire Department and for years represented the California Fire Chiefs to the International Conference of Building Officials (ICBO), publishers of the Uniform Building Code. After retiring I worked as a Fire Protection Engineer and Code Consultant. I was a member of the International Committee formed by the U. S. General Services Administration to study the fire problem involving high rise buildings following several such fires here in the United States. That Committee's findings were instrumental in developing building code requirements for such buildings and which appeared in the three model building codes. As a result of that work, I became acquainted with Chief O'Hagan, your Fire Marshal, and another Deputy Chief whose names I have forgotten.

My concern over the arrangement of exit stairways as I understand were in the World Trade Center buildings is based on radio, television, newspaper, and magazine reports. I have not seen any official reports so my understanding may be inaccurate. It is my understanding that the stairway enclosures were a part of the center core of the buildings, relatively close to each other. Because of this proximity to each other, when one was blocked, so was the other and all the building occupants above that blockage level had no means of escape.

Having worked with building codes for many years, and since all three of the model codes are reasonably similar, I would like to examine the code changes made in the Uniform Building Code and with a final look at the requirements of the International Building Code - 2000 and the NFPA Life Safety Code, 2000. At least as early as 1949, buildings five or more stories in height were required to have "one of the required exits shall be a smokeproof enclosure." That would mean that there was to be no opening directly into the interior of the building by that enclosure. Access was to be via a vestibule opening into the building itself. The vestibule was to have one door to the interior of the building and one to the stairway as a smoke-

proof enclosure. No point in the building was to be more than 150 feet from an enclosed stairway. In 1964 this distance was increased to 200 feet in a sprinklered building.

As to the location of exit stairways, "If two or more exits are required, they shall be arranged a reasonable distance apart so that if one becomes blocked the other will be available." This was later modified to require "If only two exits are required they shall be placed a distance apart equal to not less than one-fifth the perimeter of the room." The measurement was to be in a straight line between exits. The reference to two exits was later changed to three.

In 1970 or 1973 the code was modified to permit the smokeproof enclosure to be as stated above (natural ventilation) or by mechanical ventilation as would be necessary with a central core concept. The central core concept placed the elevators, stairways, restroom facilities, janitor closets, etc. in a limited rectangular area in the center of the building. Exit stairs were no longer on the outer edge of the building. The central core concept was adopted to provide more rental space and more desirable locations in the building. As to the Arrangement of Exits "If only two exits are required they shall be placed a distance apart equal to not less than one-half of the length of the maximum overall diagonal dimension of the building or area to be served measured in a straight line between exits." An Exception was made to permit "exit separations may be measured in a direct line of travel within the exit corridor. Enclosure walls shall be not less than 30 feet apart at any point in a direct line of measurement." The 30 foot figure was selected when I objected to having two exits immediately adjacent but separated by a 2-hour fire resistive wall. I objected because I had seen too many holes or breaks in that wall. So a required separation of 30 feet was suggested without any particular reason except that it sounded like a good round figure.

Then in the 1990's further relaxations were made where exits are concerned. (See enclosures.) The distance of travel from any point in a building to an exit could be increased to 250 feet in a sprinklered building. By some interpretations this could be increased to 350 feet.

The International Building Code – 2000 further reduced the separation distance requirement between exits to one-third of the length of the maximum overall diagonal dimension of the area served by the building if it is sprinklered. This was probably taken from the 1997 NFPA Life Safety Code.

It is interesting to note that the Life Safety Code permits "Interlocking or scissors stairs shall be permitted to be considered separate exits if enclosed in accordance with 5-1.3.2 and separated from each other by 2-hour fire-resistance noncombustible construction. There shall be no penetrations or communicating openings whether protected or not between stair enclosures." Such permission almost assures close proximity of exits and the penetration of the walls has been quite normal.

So, to recap what has happened to exit requirements where the location of exits are concerned, this is what I see. In my opinion there has been a relaxation of reduction in safety, particularly in tall buildings. Where originally any point in a building was required to be within 150 feet of an enclosed stairway as measured along the path of travel, 200 feet if the building

was sprinklered. Where two exits were required, they were to be positioned a distance apart equal to not less than one-fifth of the perimeter of the building. One of the required stairways had to be a smokeproof enclosure. Originally that meant that the required vestibule (between the building interior and the enclosed stairway) had to be open to outside air. It had to exit into a public way or into a fire-rated passageway leading to a public way. That passageway was to be without other openings along the route to the outside. Where three or more exits are required, they were required to be "a reasonable distance apart so that if one became blocked others would be available."

Today it is quite different. With the addition of mechanically ventilated smokeproof enclosures; i.e. the vestibule under negative pressure and the stairway under positive pressure, both exits are to be smokeproof enclosures. When two exits are required, they are to be separated from each other by one-half of the length of the maximum overall dimension of the building measured in a straight line between exits. If there are additional exits provided, they shall be a reasonable distance apart, etc. The distance of travel from any point in the building to an exit may be 200 feet in a non-sprinklered building. In a sprinklered building the travel distance may be 250 feet. The travel distance may be increased an additional 100 feet provided that the last portion of the travel distance is within a fire-rated corridor. The travel distance is measured along the direct path of travel. There must be a minimum of 30 feet between the walls of exit enclosures measured in a straight line.

The International Building Code has added an Exception for sprinklered buildings. The separation between exit doors shall be not less than one-third of the length of the maximum overall diagonal distance of the area served.

The NFPA Life Safety Code has this same one-third distance requirement. It does not specify the number of feet of separation required. Interlocking or scissors stairways are permitted with no separation distance required but just a 2-hour fire resistive wall between adjacent stairs.

I recognize that New York City has its own building and fire codes and is probably quite similar to that of the model codes. I believe that New York is a dominant figure in the design and construction of tall buildings. So, I would like to request that you examine the current provisions for exiting stairways and make a determination as to the need for revisions. What New York does in this regard may well influence the rest of the country.

Respectfully,

John "Gus" Degenkolb

Sec. 3301. (a) **Purpose.** The purpose of this Chapter is to provide minimum standards of egress facilities for occupants of buildings.

(b) **Scope.** Every building shall be provided with exits as required by this Chapter. Where there is conflict between a general requirement and a specific requirement for an individual occupancy, the specific requirement shall be applicable.

(c) **Definitions.** "Occupant Load" is the total number of persons actually occupying a building or portion thereof at any one time, but shall never be assumed to be less than the result obtained by dividing the floor area by the square feet per occupant set forth in Table No. 33-A for the occupancy housed therein.

(c) **Number of Exits.** Group D and Divisions 1 and 2 of Group H occupancies having an occupant load of more than 10 shall have not less than two exits.

Other occupancies having an occupant load of more than 50 shall have not less than two exits.

Buildings or portion thereof having an occupant load of 500 to 999 shall have not less than three exits.

Buildings or portion thereof having an occupant load of 1000 or more shall have not less than four exits.

If two or more exits are required, they shall be arranged a reasonable distance apart so that if one becomes blocked the other will be available.

(d) **Distance from Exit.** No point in any building shall be more than one hundred fifty feet (150') from an exterior exit, a horizontal exit, an enclosed stairway, or a fire-resistive passageway, measured along the line of travel.

unenclosed stairways.

Smokeproof Enclosures

Sec. 3309. (a) **General.** A smokeproof enclosure shall consist of a continuous stairway enclosed from the highest point to the lowest point by walls of two-hour fire-resistive construction. The supporting structural frame shall be of four-hour fire-resistive construction.

(b) **Where Required.** In buildings five stories or more in height, one of the required exits shall be a smokeproof enclosure.

(c) **Construction.** Stairs in smokeproof enclosures shall be of incombustible construction.

(d) **Access.** There shall be no opening directly into the interior of the building. Access shall be through a vestibule open to the outside having an exit door from the interior of the building and an exit door leading to the smokeproof enclosure. In lieu of a vestibule, access may be by way of an exterior open balcony of incombustible materials.

(e) **Doors.** Exit doors to smokeproof enclosures shall be self-closing Class "B" fire doors.

(f) **Outlet.** A smokeproof enclosure shall exit into a public way or into a passageway leading to a public way. The passageway shall be without other openings and shall have walls of two-hour fire resistance and floors and ceilings of two-hour fire resistance.

(g) **Barrier.** A smokeproof enclosure stair shall not continue below the grade level exit unless a barrier is provided at the ground floor level to prevent persons from continuing on into the basement.

General (Cont'd.)

(g) **More Than One Occupancy.** The capacity of a room or building which is used for different occupancies at different times shall be determined by the occupant load which gives the largest number of persons.

(h) **Exit Obstruction.** No obstruction shall be placed in the required width of an exit.

(i) **Room Capacity Posted.** The maximum room capacity shall be conspicuously posted by the owner of the building by means of durable metal signs placed in each assembly room, auditorium or room used for a similar purpose where fixed seats are not installed, and it shall be unlawful to remove or deface such notice or to permit more than this legal number of persons within such space.

(j) **Change in Elevation.** Changes in elevation of less than twelve inches (12"), along any means of egress within a building, shall be by means of ramps, except for occupant loads less than ten (10).

Exits Required

Sec. 3302. (a) **Number of Persons.** The number of persons permitted in any building or portion thereof shall not exceed those set forth in Table No. 33-A, except that where additional exit facilities are provided the occupancy load may be increased in accordance with Section 3302 (b) and (c).

(b) **Number of Exits.** Group D and Group H occupancies having an occupant load of more than 10 shall have not less than two exits.

Other occupancies having an occupant load of more than 50 shall have not less than two exits.

Buildings or portions thereof having an occupant load of 500 to 999 shall have not less than three exits.

Buildings or portions thereof having an occupant load of 1000 or more shall have not less than four exits.

(c) **Width.** The total width of exits in feet shall be not less than the total occupant load served divided by 50. Such width of exits shall be divided approximately equally among separate exits.

The width of exits from any story of a building shall be determined from the occupant load in that story plus one-half the tributary occupant load in the story next above or below, provided the resulting width is not less than that required for the upper story considered separately. The maximum exit width required for any story shall be maintained until egress is provided from the structure.

(d) **Arrangement of Exits.** If only two exits are required they shall be placed a distance apart equal to not less than one-fifth of the perimeter of the room. Where three or more exits are required they shall be arranged a reasonable distance apart so that if one becomes blocked others will be available.

No point in an unsprinklered building shall be more than one hundred fifty feet (150') from an exterior exit, a horizontal exit, or an enclosed stairway, measured along the line of travel.

In a building of Type I or Type II construction or where the building is completely sprinklered, the above distance from exits may be increased to two hundred feet (200').

xits Required
Continued)

The total exit width required from any story of a building shall be determined by using the occupant load of that story, plus the percentages of the occupant loads of floors which exit through the level under consideration as follows:

1. Fifty per cent of the occupant load in the first adjacent story above (and the first adjacent story below, when a story below exits through the level under consideration)

2. Twenty-five per cent of the occupant load in the story immediately beyond the first adjacent story

The maximum exit width required from any story of a building shall be maintained.

(c) Arrangement of Exits. If only two exits are required they shall be placed a distance apart equal to not less than one-fifth of the perimeter of the area served measured in a straight line between exits. Where three or more exits are required they shall be arranged a reasonable distance apart so that if one becomes blocked others will be available.

(d) Distance to Exits. No point in an unsprinklered building shall be more than one hundred and fifty feet (150') from an exterior exit door, a horizontal exit, exit passageway or an enclosed stairway, measured along the line of travel.

In a building equipped with a complete automatic fire-extinguishing system the distance from exits may be increased to two hundred feet (200').

ors

Sec. 3303. (a) General. This Section shall apply to every exit door serving an area having an occupant load of more than 10, or serving hazardous rooms or areas. Subsections (h) and (i) shall apply to all doors, regardless of occupant load.

(b) Swing. Exit doors shall swing in the direction of exit travel when serving any hazardous area or when serving an occupant load of 50 or more.

Double acting doors shall not be used as exits serving a tributary occupant load of more than 100, nor shall they be used as a part of a fire assembly, nor equipped with panic hardware. A double acting door shall be provided with a view panel of not less than two hundred square inches (200 sq. in.).

(c) Type of Lock or Latch. Exit doors shall be openable from the inside without the use of a key or any special knowledge or effort.

EXCEPTION: This requirement shall not apply to exterior exit doors in a Group F or G Occupancy if there is a readily visible, durable sign on or adjacent to the door stating "THIS DOOR TO REMAIN UNLOCKED DURING BUSINESS HOURS." The sign shall be in letters not less than one inch (1") high on a contrasting background. The locking device must be of a type that will be readily distinguishable as locked. The use of this Exception may be revoked by the Building Official for due cause.

TABLE NO. 33-A—AVAILABLE SQUARE FEET PER OCCUPANT

Use†	Minimum of Two Exits Required Where Number of Occupants Is Over	Square Feet Per Occupant
Aircraft Hangars (No repair)	10	500
Auction Rooms	30	7
Assembly Areas, Concentrated Use (without fixed seats)		
Auditoriums	50	7
Bowling Alleys (Assembly areas)		
Churches and Chapels		
Dance Floors		
Lodge Rooms		
Reviewing Stands		
Stadiums		
Assembly Areas, Less-concentrated Use	50	15
Conference Rooms		
Dining Rooms		
Drinking Establishments		
Exhibit Rooms		
Gymnasiums		
Lounges		
Skating Rinks		
Stages		
Children's Homes and Homes for the Aged	5	80
Classrooms	20	20
Dormitories	10	50
Dwellings	10	300
Garage, Parking	30	200
Hospitals and Sanitariums-Nursing Homes	5	80
Hotels and Apartments	10	200
Kitchen—Commercial	30	200
Library Reading Room	50	50
Locker Rooms	30	50
Mechanical Equipment Room	30	300
Nurseries for Children (Day-care)	5	50
Offices	30	100
School Shops and Vocational Rooms	50	50
Stores—Retail Sales Rooms		
Basement	50	20
Ground Floor	50	30
Upper Floors	10	50
Warehouses	30	300
All Others	50	100

†Refer to Sections 3315, 3319, 3320 for other special requirements.

Doors
(Continued)

flush bolts or surface bolts are prohibited.

EXCEPTION: Surface bolts of not less than one-half inch by 2 inch (½" x 2") steel stock with a three-fourths inch (¾") minimum diameter control knob may be permitted. There shall be no more than [illegible]

For purposes of this section, basements and occupied roofs shall be provided with exits as required for stories.

EXCEPTIONS: Occupied roofs on Group R, Division 3 Occupancies may have one exit if such occupied areas are less than 500 square feet and are located no higher than immediately above the second story.

Floors complying with the provisions for mezzanines as specified in Section [illegible] shall be provided with exits as specified therein.

The second story shall be provided with not less than two exits when the occupant load is 10 or more. Occupants on floors above the second story and in basements shall have access to not less than two separate exits from the floor or basement.

EXCEPTIONS: 1. Two or more dwelling units on the second story or in a basement may have access to only one common exit when the total occupant load served by that exit does not exceed 10.

2. Except as provided in Table No. 33-A, only one exit need be provided from the second floor or a basement within an individual dwelling unit or a Group R, Division 3 congregate residence.

3. When the third floor within an individual dwelling unit or a Group R, Division 3 congregate residence does not exceed 500 square feet, only one exit need be provided from that floor.

4. Floors and basements used exclusively for service of the building may have one exit. For the purposes of this exception, storage rooms, laundry rooms, maintenance offices and similar uses shall not be considered as providing service to the building.

5. Storage rooms, laundry rooms and maintenance offices not exceeding 300 square feet in floor area may be provided with only one exit.

6. Elevator lobbies may have one exit provided the use of such exit does not require keys, tools, special knowledge or effort.

For special requirements see the following sections: Group A, Section 3317; Group E, Section 3318; Group H, Section 3319; Group I, Section 3320; Rooms Containing Fuel-fired Equipment and Cellulose Nitrate Handling Rooms, Section 3321; Reviewing Stands, Grandstands and Bleachers, Section 3322; Laboratories, Sections 702 (c) and 802 (d); and Open Parking Garages, Section 709 (g). For stage exits, see Section 3903 (f).

Every story or portion thereof having an occupant load of 501 to 1,000 shall not have less than three exits.

Every story or portion thereof having an occupant load of 1,001 or more shall not have less than four exits.

The number of exits required from any story of a building shall be determined by using the occupant load of that story plus the percentages of the occupant loads of floors which exit into the level under consideration as follows:

1. Fifty percent of the occupant load in the first adjacent story above and the first adjacent story below, when a story below exits through the level under consideration.

2. Twenty-five percent of the occupant load in the story immediately beyond the first adjacent story.

The maximum number of exits required for any story shall be maintained until egress is provided from the structure. (See Section 33[illegible].)

(b) Width. The total width of exits in inches shall not be less than the total occupant load served by an exit multiplied by 0.3 for stairways and 0.2 for other exits nor less than specified elsewhere in this code. Such widths of exits shall be divided approximately equally among the separate exits.

The maximum exit width required from any story of a building shall be maintained.

(c) Arrangement of Exits. If only two exits are required, they shall be placed a distance apart equal to not less than one half of the length of the maximum overall diagonal dimension of the building or area to be served measured in a straight line between exits.

EXCEPTION: Exit separations may be measured along a direct line of travel within the exit corridor when exit enclosures are provided as a portion of the required exit and are interconnected by a one-hour fire-resistive corridor conforming to the requirements of Section 3305. Enclosure walls shall not be less than 30 feet apart at any point in a direct line of measurement.

Where three or more exits are required, at least two exits shall be placed a distance apart equal to not less than one half of the length of the maximum overall diagonal dimension of the building or area to be served measured in a straight line between the exits, and the additional exits shall be arranged a reasonable distance apart so that if one becomes blocked the others will be available.

(d) Distance to Exits. The maximum distance of travel from any point to an exterior exit door, horizontal exit, exit passageway or an enclosed stairway in a building not equipped with an automatic sprinkler system throughout shall not exceed 150 feet, or 200 feet in a building equipped with an automatic sprinkler system throughout. These distances may be increased a maximum of 100 feet when the increased travel distance is the last portion of the travel distance and is entirely within a one-hour fire-resistive corridor complying with Section 3305. See Section 3318 for Group E Occupancy and Section 3319 for Group H Occupancy travel distances.

In a one-story Group B, Division 4 Occupancy classified as a factory or warehouse and in one-story airplane hangars, the exit travel distance may be increased to 400 feet if the building is equipped with an automatic sprinkler system throughout and provided with smoke and heat ventilation as specified in Section 3206.

In an open parking garage as defined in Section 709, the exit travel distance may be increased to 250 feet which may be measured to open stairways which are permitted in accordance with Section 3309 (a).

(e) Exits through Adjoining Rooms. Rooms may have one exit through an adjoining or intervening room which provides a direct, obvious and unobstructed means of travel to an exit corridor, exit enclosure or until egress is provided from the building, provided the total distance of travel does not exceed that permitted by other provisions of this code. In other than dwelling units, exits shall not pass through kitchens, storerooms, restrooms, closets or spaces used for similar purposes.

1004.2.3.4 Additional access to exits. Access to not less than three exits, exit-access doorways or combination thereof shall be provided when the individual or cumulative occupant load served by the exit access is 501 to 1,000.

Access to not less than four exits, exit-access doorways or combination thereof shall be provided when the individual or cumulative occupant load served by the exit access exceeds 1,000.

1004.2.4 Separation of exits or exit-access doorways. Where two or more exits or exit-access doorways are required from any level or portion of the building, at least two of the exits or exit-access doorways shall be placed a distance apart equal to not less than one half of the length of the maximum overall diagonal dimension of the area served measured in a straight line between the center of such exits or exit-access doorways. Additional exits or exit-access doorways shall be arranged a reasonable distance apart so that if one becomes blocked, the others will be available.

EXCEPTION: The separation distance determined in accordance with this section may be measured along a direct path of exit travel within a corridor serving exit enclosures. The walls of any such exit enclosure shall not be less than 30 feet (9144 mm), measured in a straight line, from the walls of another exit enclosure.

1004.2.5 Travel distance.

1004.2.5.1 General. Travel distance is that distance an occupant must travel from any point within occupied portions of the exit access to the door of the nearest exit. Travel distance shall be measured in a straight line along the path of exit travel from the most remote point through the center of exit-access doorways to the center of the exit door. Travel distance shall include that portion of the path of exit travel through or around permanent construction features and building elements. Travel around tables, chairs, furnishings, cabinets and similar temporary or movable fixtures or equipment need not be considered as the normal presence of such items is factored into the permitted travel distance.

Unless prohibited elsewhere in this chapter, travel within the exit access may occur on multiple levels by way of unenclosed stairways or ramps. Where the path of exit travel includes unenclosed stairways or ramps within the exit access, the distance of travel on such means of egress components shall also be included in the travel distance measurement. The measurement along stairways shall be made on a plane parallel and tangent to the stair tread nosings in the center of the stairway.

1004.2.5.2 Maximum travel distance. The travel distance to at least one exit shall not exceed that specified in this section.

Special travel distance requirements are contained in other sections of this code as follows:

1. For atria, see Section 402.5.
2. For Group E Occupancies, see Section 1007.3.
3. For Group H Occupancies, see Section 1007.4.
4. For malls, see Sections 404.4.3 and 404.4.5.

1004.2.5.2.1 Nonsprinklered buildings. In buildings not equipped with an automatic sprinkler system throughout, the travel distance shall not exceed 200 feet (60 960 mm).

1004.2.5.2.2 Sprinklered buildings. In buildings equipped with an automatic sprinkler system throughout, the travel distance shall not exceed 250 feet (76 200 mm).

1004.2.5.2.3 Corridor increases. The travel distances specified in Sections 1004.2.5.2.1, 1004.2.5.2.2, 1004.2.5.2.4 and 1004.2.5.2.5 may be increased up to an additional 100 feet (30 480 mm) provided that the last portion of exit access leading to the exit occurs within a corridor. The length of not be less than the amount of the increase ta

1004.2.5.2.4 Open parking garages. In a G open parking garage as defined in Section 3 tance shall not exceed 300 feet (91 440 mm equipped with an automatic sprinkler system feet (121 920 mm) in a building equipped with kler system throughout. The travel distance in open stairways which are permitted in accord 1005.3.2.1

1004.2.5.2.5 Factory, hazardous and storage one-story building classified as a Group H, Div pair hangar, or as a Group F or Group S Occupa tance shall not exceed 300 feet (91 440 mm) and to 400 feet (121 920 mm) if the building is equi matic sprinkler system throughout and is al smoke and heat ventilation as specified in Sect

1004.2.6 Dead ends. Where more than one e doorway is required, the exit access shall be a there are no dead ends in hallways and corridors (6096 mm) in length.

1004.3 Exit-access Components.

1004.3.1 General. Exit-access components inc design of the exit-access portion of the means shall comply with the requirements of Section 1

1004.3.2 Aisles.

1004.3.2.1 General. Aisles serving as a portion in the means of egress system shall comply with of Section 1004.3.2. Aisles shall be provided fr portions of the exit access that contain seats, tab displays, and similar fixtures or equipment.

1004.3.2.2 Width in occupancies without fi width of aisles in occupancies without fixed seat mined in accordance with the following:

1. In areas serving employees only, the minim shall be 24 inches (610 mm), but not less than mined as specified in Section 1003.2.3.

2. In public areas of Groups B and M Occup assembly occupancies without fixed seats, the aisle width shall be 36 inches (914 mm) where se nishings, displays and similar fixtures or equipme only one side of the aisle and 44 inches (1118 mm) tures or equipment are placed on both sides of the

The required width of aisles shall be unobstruct

EXCEPTION: Handrails and doors, when fully reduce the required width by more than 7 inches (any position shall not reduce the required width by m Other nonstructural projections such as stair and simil tures may project into the required width 3½ inche each side.

1004.3.2.3 Occupancies with fixed seats. Aisles i with fixed seats shall comply with the requirements

1004.3.2.3.1 Width. The clear width of aisles shal the number of fixed seats served by such aisles width of aisles serving fixed seats shall not be used purpose.

The minimum clear width of aisles in buildings wi protected assembly seating shall be in accordance 10-C.

The minimum clear width of aisles in buildings w protected assembly seating has been established and